

Serial No. 10/042,878
Filing Date Jan.9, 2002

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Remarks

The Examiner has objected to claims 4, 6, and 8 under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

The Examiner has rejected claims 1-6, 8, 12, 14-23 under 35 USC 102(b) as being anticipated by Padmanaban. Under 35 USC 103(a), the Examiner has rejected the following claims: claim 7 as being unpatentable over Padmanaban as applied to claim 1, and further in view of Hyakutake, claims 9-11 as being unpatentable over Padmanaban as applied to claim 1, and further in view of Puligadda, claims 24 and 25 as being unpatentable over Padmanaban as applied to claim 1, and further in view of Malik, and finally claim 25 as being unpatentable over Padmanaban as applied to claim 1, and further in view of Yoon.

In claims 4, 6, and 8 the term "substantially" has been deleted.

The present invention claims a process for forming an image on a substrate, comprising the steps of:

(a) coating on the substrate a first layer of a radiation sensitive antireflective composition;

(b) coating a second layer of a photoresist composition onto the first layer of the antireflective composition;

(c) selectively exposing the coated substrate from step (b) to actinic radiation; and

(d) developing the exposed coated substrate from step (c) to form an image;

wherein both the photoresist composition and the antireflective composition are exposed in step (c); both are developed in step (d) using a single developer; wherein the antireflective composition of step (a) is a first minimum bottom antireflective coating (B.A.R.C.) composition, having a solids content of up to about 8% solids, and a maximum coating thickness of the coated

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substrate of $\frac{\lambda}{2n}$ wherein λ is the wavelength of the actinic radiation of step (c) and n is the refractive index of the B.A.R.C. composition.

The present invention discloses a bottom antireflective coating which is developed using the same developer as is used to develop the top photoresist, as is shown in claim 1, "both are developed in step (d) using a single developer." Padmanaban describes an invention where the top photoresist is developed in an aqueous alkaline solution of tetramethylammonium hydroxide. However, nowhere in Padmanaban's application is there any teaching or exemplification of an instance where the same developer is used to remove the bottom antireflective coating as the top photoresist. In fact, all the examples describe a process where the bottom antireflective coating is etched using oxygen and fluoride gas plasma. In fact, Padmanaban summarizes that a "good bottom antireflective coating should satisfy the following properties;.....d) etch rate much higher than the photoresist;..." paragraph 10. Throughout the application reference is made to etching, which clearly is a gaseous plasma etching process, requiring a distinctly separate vacuum processing step, different from the development step of the photoresist. Photoresists are exposed through a mask and then have to be selectively developed in a developer that can distinguish between the unexposed area and the exposed areas. Etching requires a patterned photoresist image in intimate contact with the antireflective coating to be etched and cannot be carried out at the same time, and using the same developer, as the photoresist. It is well known to those of ordinary skill in the art that gaseous etching is a step carried out in a vacuum chamber using plasma generated by selective gases.

The examiner cites that paragraph 86 discloses "The antireflective coating will not remain upon developing (i.e. single developer)" In paragraph 86, Padmanaban discloses "In addition, footing or remaining of the coating upon development do not take place,...Therefore, a resist pattern with high resolution and high accuracy can easily be formed" The question here is which coating is being referred to: photoresist coating or antireflective coating? The applicants are

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convinced that within the context of the prior art reference the coating referred to by Padmanaban is the photoresist coating, which is cleanly developed and not "remaining.. upon development", since the resist coating does not have footing problem nor a residual presence of the photoresist (known as scum), and these good characteristics lead Padmanaban to state "Therefore, a resist pattern with high resolution and high accuracy can easily be formed". There is no clear teaching in the Padmanaban's application that the bottom antireflective coating is being developed with a developer that is the same as the one used to develop the photoresist, that is, a tetramethylammonium hydroxide solution. In the Examples, the only removal of the antireflective coating is undertaken "using oxygen and fluoride gas plasma", paragraph 47, and specific etch rates are disclosed in lithographic Examples 1-12. As explained earlier, this etching step for the antireflective coating is a distinctly different step from the aqueous alkaline development step for the photoresist. The sole phrase within a sentence, cited by the Examiner in paragraph 87, which is ambiguous and not associated with any teaching, cannot be used as the basis of rejection. Further, the specification of Padmanaban is nonenabling as to the process of developing the antireflective coating, as disclosed in the present invention. The prior art provides no impetus to do what the present inventors have done, and furthermore, the examiner has reconstructed the claimed invention out of an isolated phrase in the prior art.

In conclusion, Padmanaban does not clearly teach in the specification nor show in any of the examples, an instance where the photoresist and the bottom antireflective coating are developed continuously in a single step, and furthermore, using the same tetramethylammonium hydroxide developer. Thus, it is presented to the Examiner, that the present applicants' invention is not anticipated by Padmanaban's disclosure.

Therefore, the process described in the present invention is distinctly different from Padmanaban's invention. The applicants request that the Examiner withdraw the invention based on Padmanaban.

The Examiner has rejected the claims under 35 USC 103(a). Since the applicants have presented the above argument to have Padmanaban removed

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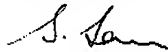
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as a prior art reference, and with this reference removed, it is requested that the other references cited by the Examiner also be removed and the rejection be withdrawn.

In view of the above amendments and remarks, the present application is believed to be in condition for allowance, and reconsideration of it is requested. If the Examiner disagrees, she is requested to contact the attorney for Applicants at the telephone number provided below.

Respectfully submitted,



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